

20040304.ba v03_n615.bam.20040304

>From ???@??? Thu Mar 4 21:48:41 2004 -0600
Message-Id: <200403050348.i253mDCQ019545@sco.theporch.com>
Date: Thu, 4 Mar 2004 21:47:37 CST
From: Old Tube Radios <boatanchors@theporch.com>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: BOATANCHORS digest 3615

BOATANCHORS Digest 3615

Topics covered in this issue include:

- 1) RE: "Snake Oils"
by Jim321@webtv.net (Jim Skladany)
- 2) Re: 6X5 THREAD
by stuck in 50s <polepeeg@aa4rm.ba-watch.org>
- 3) Re: Speaking of audio snake oil...
by "Arden Allen" <gumbear@pacbell.net>
- 4) Had Enough...
by David Stinson <arc5@ix.netcom.com>
- 5) Is selenium poisonous?
by "Herbert M. Rosenthal" <herbrose@comcast.net>
- 6) Re: Is selenium poisonous?
by "Russ WQ3X" <wq3x@mail.ptd.net>
- 7) Re: 6X5 THREAD
by "Ken Hickman" <n5cm@rtconline.com>
- 8) FS: Measurements Corp Model 65B sig gen
by john <johnmb@nc.rr.com>
- 9) Re: Is selenium poisonous?
by Jack Harper <jharper@bsi2000.com>
- 10) Re: Had Enough...
by Richard Loken <richardlo@admin.athabasca.ca>
- 11) Re: BOATANCHORS digest 3613, Item #14
by Jim321@webtv.net (Jim Skladany)
- 12) Re: Is selenium poisonous?
by Richard Loken <richardlo@admin.athabasca.ca>
- 13) Re: Had Enough...
by Bob Roehrig <broehrig@aurora.edu>
- 14) Re: Had Enough...
by Niel Wiegand <w0vlz@arrl.net>
- 15) RE: Speaking of audio snake oil...
by "John Page" <k4kwm@hotmail.com>
- 16) RE: "Snake Oils"
by "John Page" <k4kwm@hotmail.com>
- 17) Re: SS rectifier replacements
by "Barry L. Ornitz" <ornitz@tricon.net>
- 18) 1N4007's for 6X5's

by Henry van Cleef <vancleef@eskimo.com>

From: Jim321@webtv.net (Jim Skladany)
Date: Thu, 4 Mar 2004 11:32:31 -0800 (PST)
To: Old Tube Radios <boatanchors@theporch.com>
Subject: RE: "Snake Oils"
Message-ID: <24660-4047844F-2092@storefull-3177.bay.webtv.net>
Content-Disposition: Inline
Content-Type: Text/Plain; Charset=US-ASCII
Content-Transfer-Encoding: 7Bit
MIME-Version: 1.0 (WebTV)

Don't forget to make sure your equipment is LEVEL, else the electrons might tend to 'pool-up' and not be distributed evenly. (wanna buy some underwater property?) Tah tah, Jim Skladany.

Date: Thu, 4 Mar 2004 16:33:31 -0500 (EST)
From: stuck in 50s <polepeeg@aaa4rm.ba-watch.org>
Message-Id: <200403042133.i24LXVL20011@barnjob.ba-watch.org>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: 6X5 THREAD

...series adding

now THERE's a good idea

Message-ID: <000701c40231\$56ebe610\$bbe57443@KB6NAX>
From: "Arden Allen" <gumbear@pacbell.net>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: Speaking of audio snake oil...
Date: Thu, 4 Mar 2004 13:40:36 -0800
MIME-Version: 1.0
Content-Type: text/plain;
charset="iso-8859-1"
Content-Transfer-Encoding: 7bit

> Who want's a dry sounding SP-600? ...

And to think of all the trouble we go to to get rid of the waxies that have soaked up enough moisture to give us that "all wet" sound! Shudda left them in....

Arden Allen
KB6NAX

Message-ID: <4047AD38.298EBF80@ix.netcom.com>
Date: Thu, 04 Mar 2004 16:27:04 -0600
From: David Stinson <arc5@ix.netcom.com>
MIME-Version: 1.0
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Had Enough...
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

I've about had enough of seeing 70% or better of the BA
digest edition I get every day look like this:

```
* * * * *
*      ---REMAINDER OF MESSAGE TRUNCATED---      *
*      This post contains a forbidden message format      *
*      (such as an attached file, a v-card, HTML formatting) *
*      Mail Lists at theporch.com only accept PLAIN TEXT      *
*      If your postings display this message your mail program *
*      is not set to send PLAIN TEXT ONLY and needs adjusting *
* * * * *
```

And, from the replies, it's obvious that *other* people
are reading these posts just fine.

Please- either tell me how to read them as you other
folks are doing, or let me outta here...

Dave S.

Message-ID: <4047AFFB.F4796B12@comcast.net>
Date: Thu, 04 Mar 2004 15:38:54 -0700
From: "Herbert M. Rosenthal" <herbrose@comcast.net>
MIME-Version: 1.0
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Is selenium poisonous?
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

All these threads on rectifiers joggled my brain and what came loose was a
warning I remember from the late '40s or 1950s-that the selenium rectifiers
could be poisonous, literally, if the vapor was inhaled as one blew, or if one
had been smoked, and the powder got into a cut. I guess one was to wear gloves
when replacing the rectifier.

I changed out quite a few in them there days, and never had a problem.... I

think.

Anyone else remember this?

Herb Rosenthal W5AN

Message-ID: <001c01c4023b\$0d9aeec0\$1602a8c0@WorkGroup>
From: "Russ WQ3X" <wq3x@mail.ptd.net>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: Is selenium poisonous?
Date: Thu, 4 Mar 2004 17:50:11 -0500

Dunno Herb -
I never smoked one. heh heh heh.
Russ WQ3X

Subject: Is selenium poisonous?

> the selenium rectifiers
> could be poisonous, literally, if the vapor was inhaled as one blew, or if
one
> had been smoked, and the powder got into a cut.
> Anyone else remember this?
>
> Herb Rosenthal W5AN
>
>

Message-ID: <00b101c4023b\$6d15fca0\$414e9844@dell4100>
From: "Ken Hickman" <n5cm@rtconline.com>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: 6X5 THREAD
Date: Thu, 4 Mar 2004 16:52:52 -0600
MIME-Version: 1.0
Content-Type: text/plain;
charset="iso-8859-1"
Content-Transfer-Encoding: 7bit

Hi Robert & Gang,

Well, I specified the "unused filament winding"....Obviously, you can't use
this method if the equipment does not have a "separate filament winding
for the rectifier(s)....

Ken....N5CM....

----- Original Message -----

From: <WA5CAB@cs.com>

To: "Old Tube Radios" <boatanchors@theporch.com>

Sent: Thursday, March 04, 2004 11:17 AM

Subject: Re: 6X5 THREAD

> Chuck & Group,

>

> Using another winding on a transformer to buck or boost the output voltages

> certainly works and doesn't seem to get mentioned much anymore. However, if I

> correctly recall the type of set that started this thread, seems like the > complaint was penny-pinching in the transformer department by using 6.3 volt

> indirectly heated cathode rectifier tubes to eliminate the 5.2 VAC rectifier heater

> winding, running all of the tubes in the set off of one 6.3 V winding. In > this case, connecting it to the primary might well be disastrous. Plus boosting

> the advertising tube count by one. :-) If however they used a pair of > 6X5GT's and gave them their own heater winding, then it would be just as you say.

> Work a little better in fact.

>

> In a message dated 3/4/2004 10:33:55 AM Central Standard Time,

> n5cm@rtconline.com writes:

> > Don't overlook an easy way to lower the voltage somewhat by > > using the "now unused rectifier filament winding" on the power > > transformer....

> > By connecting this winding in "series adding" with the transformer > > primary winding you lower the "turns ratio" which lowers the > > output voltage....

> > Connect the filament winding in series with the primary winding > > and check voltage output from power supply - if voltage is > > higher than it was originally, reverse the two filament leads > > and reconnect....This will lower the voltage output.... A > > seeming little known but easy way to cut down on the output > > voltage....

> > Good luck!

> >

>

> 73

> Robert Downs - Houston

> <<http://www.wa5cab.com>> (Web Store)
> <wa5cab@cs.com> (Primary email)
> <wa5cab@houston.rr.com> (Backup email)
>

Message-Id: <3.0.3.32.20040304181027.02b3abc4@pop-server.nc.rr.com>
Date: Thu, 04 Mar 2004 18:10:27 -0500
To: Old Tube Radios <boatanchors@theporch.com>
From: john <johnmb@nc.rr.com>
Subject: FS: Measurements Corp Model 65B sig gen
Mime-Version: 1.0
Content-Type: multipart/mixed; x-avg-checked=avg-ok-48FE4382;
boundary="=====[181EF5C](#)====="

--=====[181EF5C](#)=====

Content-Type: text/plain; x-avg-checked=avg-ok-48FE4382; charset=us-ascii
Content-Transfer-Encoding: 8bit

This has been my faithful benchmate for a number of years, and it's still working great.

-----The particulars-----

Measurements Corp (of Boonton Mass) Sig Gen
Big!
.08-30 Mhz in six bands
Big!
Calibrated output from .1 uV to 1V
Big!
Audio gen, 400 and 1Khz, w/percent modulation continuously variable
Big!

All working ok, dial calibration amazingly accurate and a dependable accurate generator.

Did I mention it was big? It's actually only about 19"x10"x12" but it's pretty heavy, in it's black wrinkle splendor.

I won't ship this, but I'll be happy to meet the purchaser at any of the hamfests in the central NC area, or environs. I'd like to get a whopping \$40 for it. I'll provide pictures this weekend if anyone's interested.

Seriously, this is a very good piece of gear. There's one thing not working... the motor pushbutton frequency changing buttons (likely of marginal utility anyway). The built in vernier works just fine.

Inquire at::

johnmb@nc.rr.com

73

John K5MO

--=====181EF5C=====

Content-Type: text/plain; charset=us-ascii; x-avg=cert; x-avg-checked=avg-ok-48FE4382

Content-Disposition: inline

Checked by AVG anti-virus system (<http://www.grisoft.com>).

Version: 6.0.580 / Virus Database: 367 - Release Date: 2/6/04

--=====181EF5C=====

Message-Id: <6.0.3.0.1.20040304155318.0434be20@mail.bsi2000.com>

Date: Thu, 04 Mar 2004 15:55:54 -0700

To: Old Tube Radios <boatanchors@theporch.com>

From: Jack Harper <jharper@bsi2000.com>

Subject: Re: Is selenium poisonous?

Mime-Version: 1.0

Content-Type: text/plain; charset="us-ascii"; format=flowed

At 03:38 PM 3/4/2004, Herb W5AN wrote:

>All these threads on rectifiers joggled my brain and what came loose was a
>warning I remember from the late '40s or 1950s-that the selenium rectifiers
>could be poisonous, literally, if the vapor was inhaled as one blew, or if one
>had been smoked, and the powder got into a cut. I guess one was to wear gloves
>when replacing the rectifier.

>

>I changed out quite a few in them there days, and never had a
>problem.... I think.

On 1 September 1999, Barry Ornitz, the Resident Chemist, said:

=====

Hazardous Material - I<snip> The magazines
would not be allowed to print it today. Selenium compounds are EXTREMELY
toxic. This is why I always recommend replacing selenium rectifiers with
modern diodes. You can leave the disconnected stack in place for looks but
wire a much smaller diode below the chassis if you want an authentic look.

=====

Regards to the List --

Jack, W0YJ
Evergreen, Colorado USA

Jack Harper
303.231.9095

BSI2000, Inc.
Denver, Colorado USA

<http://www.bsi2000.com> (Last Update: 040115)

Date: Thu, 04 Mar 2004 16:21:11 -0700 (MST)
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: Had Enough...
To: Old Tube Radios <boatanchors@theporch.com>
Cc: Old Tube Radios <boatanchors@theporch.com>
Message-id: <Pine.PMDF.3.95.1040304161718.541116454R-1000000@admin.athabascau.ca>
MIME-version: 1.0
Content-type: TEXT/PLAIN; charset=US-ASCII

On Thu, 4 Mar 2004, David Stinson wrote:

> I've about had enough of seeing 70% or better of the BA
> digest edition I get every day look like this:

Sometimes there is a text portion as well as an HTML portion so, in my case
I use Pine and I push the right button to read the text attachment.

Rarely.

Generally I assume that if the message was sent as HTML then the sender had
nothing useful to say anyway. I also assume that if my employers sends me a
Word Doc attachment that it doesn't hold anything worth reading.

The problem with being 50 is I can get away with a real bad attitude.

--

Richard Loken VE6BSV, Systems Programmer - VMS
Athabasca University
Athabasca, Alberta Canada
** richardlo@admin.athabascau.ca **

From: Jim321@webtv.net (Jim Skladany)
Date: Thu, 4 Mar 2004 15:24:24 -0800 (PST)
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: BOATANCHORS digest 3613, Item #14
Message-ID: <17566-4047BAA8-2668@storefull-3176.bay.webtv.net>
Content-Disposition: Inline
Content-Type: Text/Plain; Charset=US-ASCII
Content-Transfer-Encoding: 7Bit
MIME-Version: 1.0 (WebTV)

As 'ole P.T. used to say, "there's one born every minute". "Bandini Baloney" @\$1799 per 40". OUCH, OUCH, OUCH, Heh Heh Heh. Jim Skladany.

Date: Thu, 04 Mar 2004 16:32:49 -0700 (MST)
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: Is selenium poisonous?
To: Old Tube Radios <boatanchors@theporch.com>
Cc: Old Tube Radios <boatanchors@theporch.com>
Message-id: <Pine.PMDF.3.95.1040304163120.541116454U-1000000@admin.athabascau.ca>
MIME-version: 1.0
Content-type: TEXT/PLAIN; charset=US-ASCII

On Thu, 4 Mar 2004, Jack Harper wrote:

> On 1 September 1999, Barry Ornitz, the Resident Chemist, said:
>
> Hazardous Material - I<snip> The magazines
> would not be allowed to print it today. Selenium compounds are EXTREMELY
> toxic. This is why I always recommend replacing selenium rectifiers with
> modern diodes. You can leave the disconnected stack in place for looks but
> wire a much smaller diode below the chassis if you want an authentic look.

Meanwhile selenium is an essential trace element in your diet. You can't hardly win.

--

Richard Loken VE6BSV, Systems Programmer - VMS
Athabasca University
Athabasca, Alberta Canada
** richardlo@admin.athabascau.ca **

Date: Thu, 4 Mar 2004 20:26:26 -0600 (CST)
From: Bob Roehrig <broehrig@aurora.edu>
To: Old Tube Radios <boatanchors@theporch.com>

cc: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: Had Enough...
Message-ID: <Pine.OSF.4.58.0403042025410.35500@mail.aurora.edu>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII

On Thu, 4 Mar 2004, David Stinson wrote:

> I've about had enough of seeing 70% or better of the BA
> digest edition I get every day look like this:
>
> * * * * *
> * ---REMAINDER OF MESSAGE TRUNCATED--- *
> * This post contains a forbidden message format *

NO _ YOU"RE NOT ALONE DAVE!!!!!!

Bob Roehrig
Aurora University Telecom/IS dept.
broehrig@aurora.edu 73 de K9EUI
630-844-4898 fax 630-844-4222

Message-ID: <4047EAB3.F0177076@arrl.net>
Date: Thu, 04 Mar 2004 20:49:23 -0600
From: Niel Wiegand <w0vlz@arrl.net>
MIME-Version: 1.0
To: Old Tube Radios <boatanchors@theporch.com>
CC: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: Had Enough...
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

Dave,

Netscape (and probably that other browser) has a "view" button. Use it to view page source. Buried in the details of what went were when should be the raw text message.

73, Niel

David Stinson wrote:

>
> I've about had enough of seeing 70% or better of the BA
> digest edition I get every day look like this:

>
> * * * * *
> * ---REMAINDER OF MESSAGE TRUNCATED--- *
> * This post contains a forbidden message format *
> * (such as an attached file, a v-card, HTML formatting) *
> * Mail Lists at theporch.com only accept PLAIN TEXT *
> * If your postings display this message your mail program *
> * is not set to send PLAIN TEXT ONLY and needs adjusting *
> * * * * *
>
> And, from the replies, it's obvious that *other* people
> are reading these posts just fine.
>
> Please- either tell me how to read them as you other
> folks are doing, or let me outta here...
>
> Dave S.

From: "John Page" <k4kwm@hotmail.com>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: RE: Speaking of audio snake oil...
Date: Fri, 05 Mar 2004 03:15:46 +0000
Mime-Version: 1.0
Content-Type: text/plain; format=flowed
Message-ID: <Law11-F84lSVwJ5Pm0y00026272@hotmail.com>

You should go to their web page and check out the cable prices. For a pair of 3 foot cables they charge \$17000. No I didnt leave out the decimal point. I think they used to work in govenment contracting or something. These people or crazy like a fox. We laugh at them but they laugh all the way to the bank. John

John Page K4KWM
Hollow State since 1953
(ex W8PKU,N8BLB,NA80)

>From: charlesmorris@direcway.com
>Reply-To: charlesmorris@direcway.com
>To: Old Tube Radios <boatanchors@theporch.com>
>Subject: Speaking of audio snake oil...
>Date: Thu, 04 Mar 2004 11:28:09 -0600

>
>You may have seen this before, but this one really tripped my BS detector.
>I assume this is for real and her name is not intended to be humorous? And
>to think my ARC-5's could be sounding "meaty and chesty" just by adding a
>few caps!
>-Charles
>
> >Everyone, without exception, loves the sound with Auricaps in the gear.
>The highs are smooth and >clear without tizzyness or hash or dulling roll
>off. The Mids are meaty and full of emotion when the >source offers it.
>'Three D' sound staging should be Auricaps middle name. Bass is tight and
>well >connected, chesty and textured with power and authority. Best of all
>is not that these separate >frequency groups sound so good as separate
>elements, but that they sound so "together" and "as one >whole" when music
>plays through them. I sense no loss of rhythm, pacing, or emotion in
>circuits that >employ these parts.
> >Jennifer WhiteWolf-Crock
> >Owner: JENA LABS
>

FREE pop-up blocking with the new MSN Toolbar ñ get it now!
<http://clk.atdmt.com/AVE/go/onm00200415ave/direct/01/>

From: "John Page" <k4kwm@hotmail.com>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: RE: "Snake Oils"
Date: Fri, 05 Mar 2004 03:18:45 +0000
Mime-Version: 1.0
Content-Type: text/plain; format=flowed
Message-ID: <LAW11-F19IPdJbkXvIR00043256@hotmail.com>

Well I think the new tube stuff should be level. Else the vacuum in the
tubes will be off to one side and the sound will be tizzy and not chesty
enough. John HEHEHEHEHE

John Page K4KWM
Hollow State since 1953
(ex W8PKU,N8BLB,NA80)

>From: Jim321@webtv.net (Jim Skladany)

>Reply-To: Jim321@webtv.net
>To: Old Tube Radios <boatanchors@theporch.com>
>Subject: RE: "Snake Oils"
>Date: Thu, 4 Mar 2004 11:32:31 -0800 (PST)
>
> Don't forget to make sure your equipment is LEVEL, else the electrons
>might tend to 'pool-up' and not be distributed evenly. (wanna buy some
>underwater property?) Tah tah, Jim Skladany.
>

Create a Job Alert on MSN Careers and enter for a chance to win \$1000!
[http://msn.careerbuilder.com/promo/kaday.htm?](http://msn.careerbuilder.com/promo/kaday.htm?siteid=CBMSN_1K&sc_extcmp=JS_JASweep_MSNHotm2)
[siteid=CBMSN_1K&sc_extcmp=JS_JASweep_MSNHotm2](http://msn.careerbuilder.com/promo/kaday.htm?siteid=CBMSN_1K&sc_extcmp=JS_JASweep_MSNHotm2)

Message-ID: <00d101c40260\$f73e7cc0\$995d62d8@barry1>
From: "Barry L. Ornitz" <ornitz@tricon.net>
To: Old Tube Radios <boatanchors@theporch.com>
Subject: Re: SS rectifier replacements
Date: Thu, 4 Mar 2004 22:21:29 -0500
MIME-Version: 1.0
Content-Type: text/plain;
charset="iso-8859-1"
Content-Transfer-Encoding: 7bit

Hi friends,

After a long absence due to a motherboard failure, I am now back with a new Athlon-based machine. Fortunately Jack did not cancel my digests after numerous bounce messages with an overflowing mailbox. It will take me a while to get all the stuff off the old drives, and I cannot search

my older messages (yet), nor most of my technical data. Before I do that, I need to re-create my address book so I can finally send parts I promised to several readers. Keeping information on the computer is handy, but when the computer dies, paper copies sure would be nice!

Catching this discussion on the tail end, I would like to reply...

Nick wrote:

> Something that has been lurking in my head for a while got triggered
> by John Sehring's recent comments in the 6X5 discussion - replacing
> tube and selenium rectifiers with silicon diodes. Conventional advice is
> to stick a resistor in series to simulate the old rectifier's voltage
> drop.
> However it seems to me this has two problems
> 1 - it isn't correct except at a given current (as John pointed out)

> 2 - you are increasing the rectifier source impedance
>
> Selenium replacement commonly comes up in bias supplies
> (particularly for tube audio gear) - the current drain is often so low
I'd
> have to stick 68K or something like that in series to get the right
> voltage drop. Am I wrong to feel uncomfortable about increasing the
> source impedance so much? On the other hand, I guess if there isn't
> much average current, there isn't much need to replenish the filter cap
> quickly (principal effect of high rectifier impedance?).
>
> Wouldn't a better policy be to use a zener diode in series to get a fixed
> voltage drop without increased source impedance? Any down side to > this?
>
> Hmm, maybe I can repackage zeners and sell them at insane prices to
> "preserve that original selenium bias rectifier sound".
>
> 73 & Have Fun,
> Nick KD4CPL

To start the discussion, we need to understand that tubes and solid-state devices like selenium and silicon rectifiers behave VERY differently. It seems that tube rectifiers should be fairly well understood by most of us by now, but I am beginning to doubt this.

The current passed through a high-vacuum rectifier whose filament is not thermally limited (as in noise diodes) follows Child's Law - the plate current is proportional to the $3/2$ power of the plate to cathode voltage.

So when used as a rectifier, the voltage drop of the tube will depend on the current drawn. The vacuum rectifier may be modeled as an ideal rectifier in series with a non-linear resistance, the plate resistance, whose value depends on the current drawn. [To be even more accurate, with all rectifiers there will be a forward voltage drop even at zero current.

With vacuum rectifiers, this forward drop is slightly NEGATIVE as there will be a slight plate current even with zero volts on the plate due to the thermal energy of the hot electrons from the filament.]

With a choke input filter in a power supply drawing enough current that the choke has greater than its critical inductance, the vacuum rectifier will have a constant current and its voltage drop can be readily predicted.

But if a capacitor input filter is used, tube current flows for only portions of a cycle. With high-value capacitors, the current flows in short pulses.

This makes the prediction of the tube voltage drop difficult.

O. H. Schade probably did the best analysis of this situation. Everyone seriously interested in this topic should get a copy of his paper and read it thoroughly. [O. H. Schade: "Analysis of Rectifier Operation", Proceedings of the Institute of Radio Engineers, Volume 31, pages 341 - 361, July, 1943.]

Schade presents a graph showing the rectifier peak resistance as a function of rectifier peak plate current for a large number of common tubes. It may not be apparent from the log-log plot, but all of the 14 lines on the graph almost perfectly demonstrate Child's law.

>From the peak resistance, Schade showed that the RMS rectifier resistance and the average rectifier resistance can be calculated to within 5% with two simple relationships. The RMS resistance, when multiplied by the square of the RMS plate current, equals the plate power dissipated within the rectifier as heat. The average rectifier resistance, when multiplied by the average plate current, equals the average voltage drop across the tube (that measured by a DC meter).

Schade then presents a collection of three graphs (one each for half-wave, full-wave, and full-wave doubler circuits) where the output voltage of the capacitor input filter can be calculated knowing the transformer resistances, the load resistance and the capacitance.

He also presents graphs showing the ratios of the RMS plate current to the average (DC) plate current, and the peak plate current to the average current. [Most folks are quite surprised to discover that the RMS and peak currents can be FAR higher than the average current, especially with high capacitance values. This easily explains why silicon diodes rated at 1 amp can blow when used in a big amplifier power supply when the amplifier only draws a fraction of an amp.]

So going back to Nick's original question, if you use a silicon diode to replace a vacuum tube, because of the low internal resistance of the silicon diode, the voltage from the power supply will be higher than that produced with the original vacuum rectifier. If you add a series resistor to drop the voltage to match that produced by the vacuum tube, the voltage will be correct only at one current. At lower currents the voltage will be higher than that with the vacuum rectifier, and at higher currents the voltage will be lower.

Let me give an example for a typical tube, a 5U4G. With a peak current of 100 milliamps, the peak resistance is about 355 ohms. But changing the current around this value produces the following data from Schade's graph.

Peak Current, Amps

Peak Resistance, Ohms

0.010	760
0.020	605
0.050	445
0.100	355
0.200	280
0.500	210

[If you take this data and fit an equation to it, the best fit is

$$R_p = 165.4 * I ** -0.33$$

which is almost exactly what would be found from Child's law.]

I should note that at the current for which the resistor value was chosen, the resistor will generate exactly the same amount of heat that the tube's plate resistance would. So using the silicon diode and resistor would only eliminate the heat generated by the tube filament.

At the chosen current level, the resistor does not alter the source impedance of the power supply as it exactly matches the tube's plate resistance. At lower current levels, the solid-state rectifier will present lower impedance levels than the tube, hence also producing a higher voltage output.

Using a Zener is no real solution either. Here you have an almost constant voltage drop. This does not match a vacuum rectifier at all. It does, however, do an excellent job of matching the almost constant voltage drop of a mercury or gaseous rectifier.

Now selenium rectifiers are a "whole 'nuther ball game". I hope to cover this tomorrow as it is getting late this evening. Let me tempt the group, however, by noting that I have done considerable research (both theoretical and experimental) into selenium rectifiers and their characteristics. I will agree with Arden's statement that simply replacing a selenium stack with a properly-rated silicon diode always produces higher output voltages in power supply applications. [There may be exceptions at very low current levels but seleniums were virtually never used as detector diodes except in some cheap-ass TV's that only Marty could love.]

More on this tomorrow.

73, and it's good to be back!

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From: Henry van Cleef <vancleef@eskimo.com>
Message-Id: <200403050347.TAA04619@eskimo.com>
Subject: 1N4007's for 6X5's
To: Old Tube Radios <boatanchors@theporch.com>
Date: Thu, 4 Mar 2004 20:47:13 -0700 (MST)
MIME-Version: 1.0
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

I've been reading some of the responses here on substituting silicon diodes for 6X5 rectifiers.

My own feelings along this line run a little differently than what I've seen. You have to consider the circuits that are being fed. Most will swallow almost any B+ you feed them over about 135 volts, as long as you don't overdissipate the tubes. The value is not critical.

What is critical for most RF/IF signal amplifiers, where pentodes are used, is the screen voltage and the initial bias on remote cutoff tubes. For a 6SK7 or 6BA6, most of the time you are looking at 100 volts on the screen, 3 volts at the cathode, and a plate current around 10 ma. as the original design---one of the "typical" points given in the tube manuals. Similar parameters for 6SA7/6BE6. Some tubes like 1852 want 150 on the screen and lower initial bias. As long as the plate voltage is equal or higher than the screen, you're essentially home free. The use of 250-300 volts in a receiver with a 6V6 output is needed only to give some headroom for the output tube. Those generally run with the same voltage on the screen, but a 50L6 or 6146 MUST have a lower screen voltage.

The procedure I'd suggest is to set up your new power supply, measure voltages, and adjust the screen dropping circuit as needed to get to the original design voltage. If you want to reduce plate dissipation on output tubes, jack up the bias a bit. A 6V6 can be shoved up from 13 to 18 volts bias without any major effect on its performance. A bias increase really works well on a push-pull output stage.

Those of you on this list ten years ago will recall that I had to replace the power transformer on an RME-45 receiver, and the one I used was 750 VAC CT in place of 650 CT. This on a set that was already a very high B+ (310 volts) and that drew 135 ma. out of an 80 rectifier. I converted the filter to choke input, which knocked B+ down to 260 volts, adjusted the dividers to the VR-150 and screen supplies to get back to 100 volts, and reset the bias on the 7C5 to shove the tube up on its operating curve. That dropped B+ current to 95ma. and made a huge difference in heat on the chassis and stability. In actual fact, that's a fine set with 180 volts on the RF/IF plates.

The key is to set the operating points with the screen voltage for the supply you are using. The plate resistance of those voltage amplifier pentodes is just plain too high to be affected very much by plate voltage.

If you are dealing with triodes in an audio amplifier other than the usual 6SQ7-type AA5 layout, then you have to pay attention to plate voltage and grid bias. Put in what you need in the B+ feed and/or cathode circuits, and decouple it with 1 mike electrolytics.

If you've got an original circuit that is a cap input pi setup with a resistor between the caps, consider using a choke in place of that resistor and decreasing the value of the input cap; to reduce inrush current on turn-on, you can put a 50 ohm resistor in front of the input cap or use a pair on the AC side from the transformer to the rectifier anodes to cut dissipation in each resistor in half.

I simply don't know where these tales of AC supply voltage "inflation" are coming from, as I was dealing with 125-130 volts on the AC mains before 1950. Nominal supply of AC systems was 115/120/125 in the 1920's. 110 was only used on Edison DC systems. If you are going to measure AC supply, you had better be using instrumentation that has been recently calibrated traceable to NIST---what Simpson 260's and other VOM's display on their AC ranges can be pretty wildly off, and while Ballantine and HP VTVM's did better when they were new, you'd better recalibrate them before believing anything they indicate.

Hank

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End of BOATANCHORS Digest 3615
